

Thrust of Utilizing Zycosoil Chemical Additive for VG 10 Paving Mix

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Abstract : Road divisions are the motors of development for economy, work and strengthening. Owing to increments in family unit wage, the requests for customized vehicles have additionally expanded. The blasting exchange in the business vehicle segment has changed the truck business in India, and without a doubt for the wellbeing to meet the requests of mechanical exercises putting more weight on VG 10 adaptable roads, the impact is noted all the more fundamentally with varieties in every day and regular temperatures adding to high anxieties influencing the adaptable asphalt specially in presence of moisture too. India is overflowing with a few awful roads be it the metro urban areas, the urban communities or the towns. Thus it is our significant obligation that the highway designers and those related to it can build enduring roads with the goal that India can be at standard with the created nations of the world.

So as to adapt up to the perpetually changing atmosphere keeping in perspective dampness, new creative materials needs to be used in research facility before it can be proposed for thruway development. The present paper hence edifies the technique to figure out ideal bitumen content by Marshall Mix outline strategy for BC blend with and without utilizing inventive nanotech synthetic material Zycosoil. To 5.1 % ideal bitumen content for BC blend acquired in the research center examinations, obliged doses of Zycosoil compound in 0.02%, 0.03% and 0.04% is included and changes in properties are recorded. Additionally breaking point test is directed to focus dampness defenselessness.

Keywords – Bituminous Concrete, Marshall Mix Design, Optimum Bitumen Content, Stability value, Zycosoil.

I. PREAMBLE

In India, as of late there has been a sharp increment in populace coupled with expansion in exceedingly loaded business vehicles in constrained road space with huge varieties in every day, regular temperature and compelling ecological conditions posturing weight on roads accordingly inciting more stresses on roads. The distresses on flexible pavement are basically contributed because of harm of dampness and these outcomes in the dynamic loss of usefulness of the material owing to loss of the attachment bond between the black-top folio and the

aggregate surface. Since roads by implication add to the financial development of the nation it is greatly crucial that the roads are well laid out and solid. India is home to a few terrible roads be it the metropolitans, the urban communities or the towns. Hence configuration, development and upkeep of roads are given prime significance in the improvement of the framework of a nation.

The guideline of manageability in the 21st century directs the need of moderating assets for highway development. Durability is the key parameter of satisfactory serviceability. Zycosoil compound nanotechnology is a licensed leap forward to address these issues at a financial expense. At first in the task an endeavor has been made to recognize the engineering properties of materials and study the effects of Zycosoil on VG 10 bituminous blends with and without it, as per the codes as determined in MoRTH.

II. LITERATURE

Bala Raju Teppala, C.B. Mishra and Dinesh Kumar (2015) [1] In this paper the authors have first examined the engineering properties assessable for pulverized stones, fillers and VG 10 evaluation bitumen for blend outline. Marshall Method of mix design for DBM (grade 1) was received to figure out the ideal bitumen content. For VG 10 bituminous blend ideal bitumen substance is mulled over for Modified Marshall Mix outline by addition of 0.03%, 0.04% and 0.06% measurement of Zycosoil chemical and tried to focus on the key properties according to the codal procurement. It is proposed that VG 10 grade bitumen with 0.06% Zycosoil chemical, can be suggested for flexible pavements in colder regions too, where moisture is always evident. It is suggested that the designers, road contractors and the associated to road development can avail the use of such additive to enhance the long term performance quality while keeping up the economy for the nation. Dampness weakness is assessed utilizing boiling point test.

Goutham Sarang (2014) [2] The study has been carried out on Stone Matrix Asphalt (SMA) - a crevice audited bituminous mixture with high centralization of coarse sums and high mastic substance. In this examination SMA mixtures were masterminded by Marshall Compaction (MC) moreover in Superpave Gyratory Compactor (SGC) and their displays in lab

were taken a gander at. The mixtures were prepared using Viscosity Graded (VG 10) bitumen and a mixture named Zycosoil was used as an offsetting included substance. Volumetric properties, Marshall Characteristics, behaviour to sogginess movement thus on were dead situated in examination focus. From the outcomes it is seen that gyratory compaction is the suitable procedure to get prepared SMA mixture.

Sangita et al. (2011) [3] The effect of waste polymer modifier (nitrile versatile and polythene) on distinctive mechanical properties of the bituminous solid mixtures was surveyed. Diverse test comes about on 80/100 bitumen and aggregate satisfied the extent that this would be possible. Marshall Stability and held consistent quality tests asserted the perfect WPM substance to be 8%. The WPMB mix containing 8% WPM exhibited gigantic changes in distinctive properties of the bituminous strong mixture. The higher estimations of Marshall Stability and held soundness demonstrated extended quality and low dampness vulnerability.

Moghadas Nejad, A.R. Azarhoosh, GH.H. Hamed, M.J. Azarhoosh (2012) [4] The study concentrates on dampness harm in a black-top mixture can be characterized as the loss of quality, firmness and strength because of the vicinity of dampness prompting glue disappointment at the binder-aggregate interface and/or strong disappointment inside the folio or binder-filler mastic. So as to enhance attachment and lessen dampness affectability in black-top mixtures, two separate methodologies have ended up obvious. One methodology proposes that the total surface be covered by suitable operators that will invert the prevalent electrical charges at the surface and accordingly lessen the surface vitality of the total. In this study, the impacts of nano material, in particular Zycosoil, on the dampness harm of black-top mixtures were contemplated. Two sorts of totals that speak to an extensive territory in mineralogy, limestone and stone, were assessed amid the course of this study. To evaluate the effect of Zycosoil on dampness harm of hot blend Asphalt, control blends (without Zycosoil) and blends containing Zycosoil in dry and wet conditions were tried utilizing aberrant rigidity (ITS) and circuitous malleable weakness (ITF) tests. The outcomes demonstrated that limestone has less dampness harm potential contrasted with stone. The proportion of wet/dry estimations of ITST and ITFT for blends containing Zycosoil was higher than the control blend for two sorts of total. Nonetheless, in mixtures made of rock total, utilizing Zycosoil is more compelling. As the thickness of silanol gatherings is all the more in its surface, these gatherings are hydrophilic, and Zycosoil moves to the polar water-cherishing surface, responds with the silanol gatherings and structures siloxane bond, the strongest bond in nature, and makes an atomic level hydrophobic.

III. MATERIALS AND METHODS

Squashed stone total (coarse, fine and filler) is of vital significance as the heap is exchanged from stone to stone; additionally key interlocking is of basic validity in the degree of blend plan after the examinations of physical necessities for bituminous solid blend. In view of the degree subtle elements determined in MoRTH, totals were sieved, cleaned and oven dried by individual sizes. A few tests were led on coarse totals to discover their physical properties and the outcomes are contrasted in the accompanying table and MoRTH details.

Laboratory Tests

Physical Requirements for Coarse Aggregate for bituminous concrete (As per MoRTH Table: 500-8)

Sr. No	Property	Test	Specification	Test Result
1	Cleanliness (dust)	Grain size analysis	Max 5 % passing 0.075 IS-Sieve	3.00 %
2	Particle shape	Flakiness & Elongation Indices (Combined)	30% Max	19.61 %
3	Strength	Aggregate Impact Value(AIV)	27 % Max	8.41%
4	Durability	Soundness		
		Magnesium Sulphate	Max 18 %	0.68%
		Sodium Sulphate	Max 12 %	0.57%
5	Stripping	Coating and Stripping Bitumen Aggregate Mixtures	Min. Retained Coating 95 %	96%
6	Atterberg's Limit (As per 507.2.3)	Plasticity Index	4 %Max	Non-Plastic
7	Water absorption value	Water absorption value	2 % Max	1.27%

Table - 1

Physical Properties of Aggregates

Sr.N o	Size of Aggregate	Aggregate Proportions	Bulk Specific Gravity	Apparent Specific Gravity	Water Absor ption
1	12 - 6 mm	35%	2.854	2.956	1.21
2	6 mm down	63%	2.850	2.963	1.33
3	Filler	2%	2.650	-	-

Table – 2

The molecule size dispersion is a standout amongst the most powerful total attributes in deciding how it will execute as an asphalt material degree and aids focus on each imperative property including stiffness, stability, toughness, permeability, workability, fatigue resistance, frictional resistance and moisture susceptibility. For this reason sieve investigation of total has been carried out of BC grade 2, for this study to fulfill the MoRTH prerequisite. The graph shows the upper limit, obtained value and lower limit (as shown in Fig. 1).

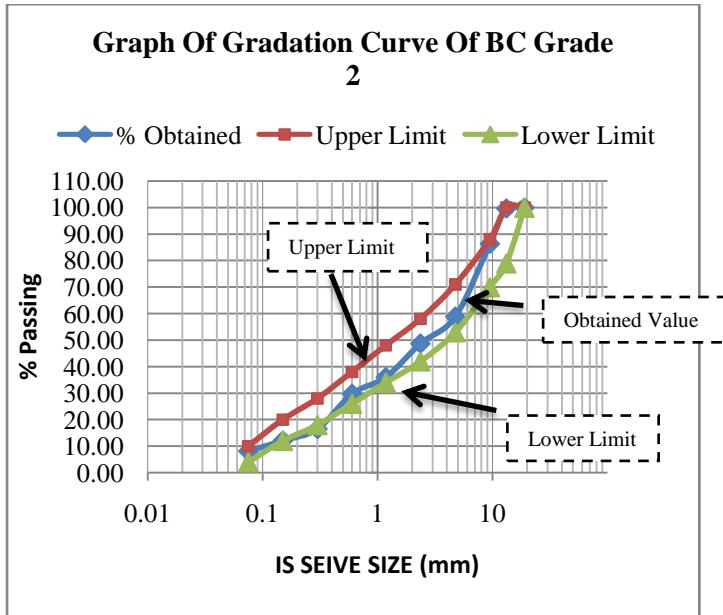


Figure.1- Graph of BC Gradation Curve (Grade 2)

IV. VG 10

Bitumen is a thermoplastic material and its solidness is liable to temperature. It is exhaustively utilized as a bit of spreading applications, for occurrence, surface-dressing and clearing in remarkably cool air. Milder thickness grades VG-10 are proposed for territories with most raised reliably mean air temperatures of 30°C and lower. The smallest regulated mean air temperatures happen in India in January. They run from -2°C to 21°C from Kashmir to Kanya Kumari. At temperatures lower than -10° C we can utilize gentler grades.

V. ZYCOSOIL AS MODIFIER

Zycosoil is a water dissolvable responsive organo-silicon fragment (size 50 to 100 μm) that is particularly proposed to upgrade the bond amidst bitumen and sums in hot mix dark top, as it is reactive and possess penetrative nanotechnology which goes inside the pores of substrate. Zycosoil artificially has the property to capacity as amines and hydrated lime to give Mother Nature's strongest security which can't be uprooted by water. Zycosoil in suitable estimations of 0.02%, 0.03% and 0.04% be

incorporated particularly by weight of spread and blending to fitting mixing at 175°C.

Summary of test results of VG 10 grade bitumen with and without Zycosoil

Characteristics of tests	VG 10	VG 10 +0.02 %Zycosoil	VG 10 +0.03 %Zycosoil	VG 10 +0.04 %Zycosoil	Min. Limit	Code
Penetration (mm)	88	88	87	84	80-100	IS 1203
Softening point (C°)	48.6	47.2	46.9	45.7	40	IS 1205
Ductility (cm)	90	82	84	85	40	IS 1208
Absolute Viscosity at 60 (C°)	855	840	865	850	800 poise	IS 1206 (2nd part)
Stripping Test	90	97	98	100	Min 95%	IS 6241

Table - 3

VI. MARSHALL STABILITY TEST FOR BC MIX DESIGN GRADE - 2

The Marshall Strength and flow test gives the execution forecast measure to the Marshall Blend outline system. The strength bit of the test measures the most extreme load bolstered by the test example at a loading rate of 50.8 mm/minute. Load is connected to the sample till failure, and the greatest load is assigned as stability. Amid the loading, a connected dial gauge measures the samples plastic flow (deformity) because of the loading. The flow worth is recorded in 0.25 mm increases in the meantime when the greatest load is recorded. This test has been done to focus the Optimum Binder Content for BC blends. Initially for BC grade 2, gradation of aggregates is carried out as per MoRTH specification and specimens are prepared with varying bitumen content. The properties incorporate with the test are stability, flow value, Bulk specific gravity, Air voids, Voids filled with bitumen and Voids in mineral aggregate is evaluated. The optimum binder content is worked out as 5.1% for BC Mix Design grading – 2.

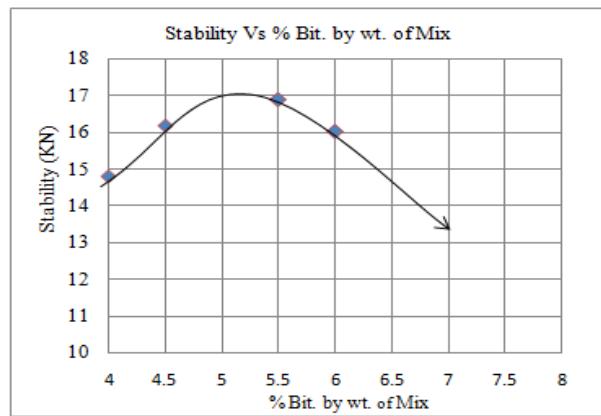


Figure.2- Marshall Stability v/s Bitumen Content

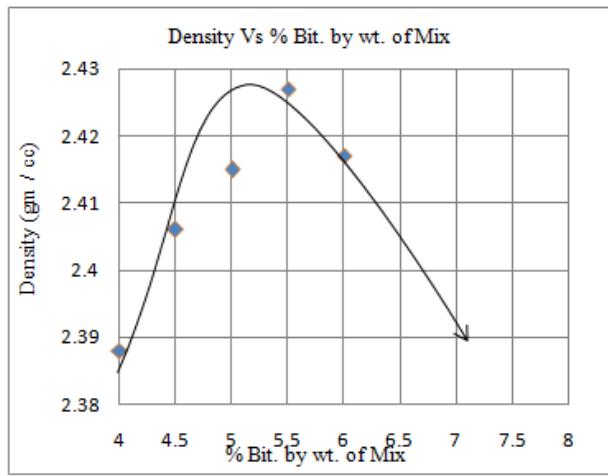


Figure.3- Bulk Density v/s Bitumen Content

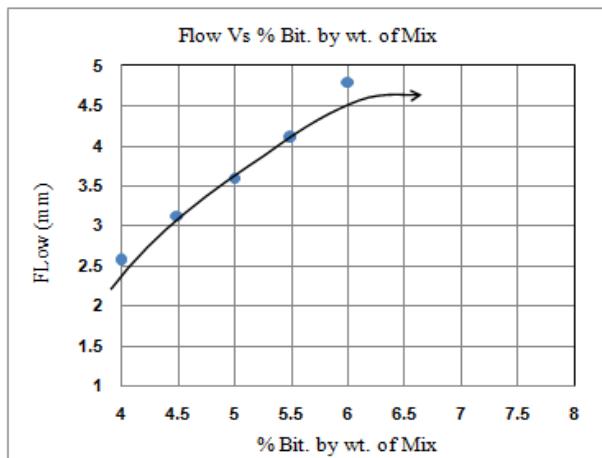


Figure.4- Marshall Flow v/s Bitumen Content

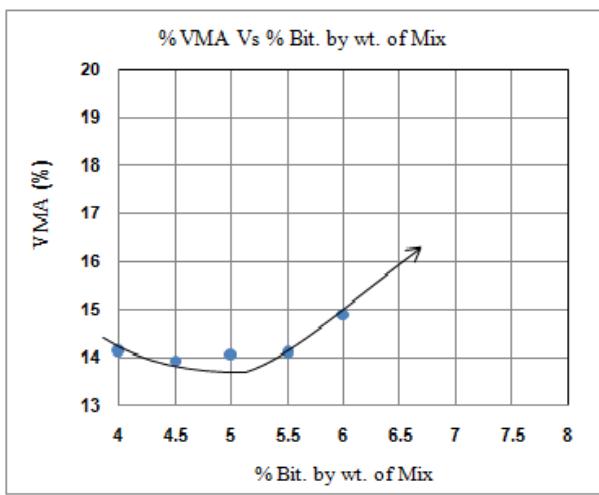


Figure.5- Voids in Mineral Aggregates v/s Bitumen Content

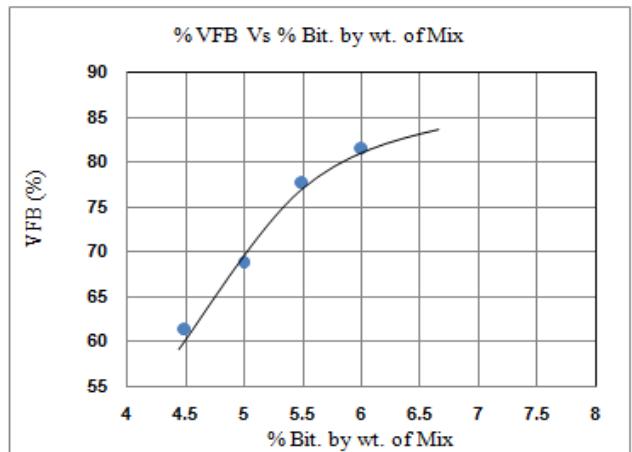


Figure.6- Voids Filled with Bitumen v/s Bitumen Content

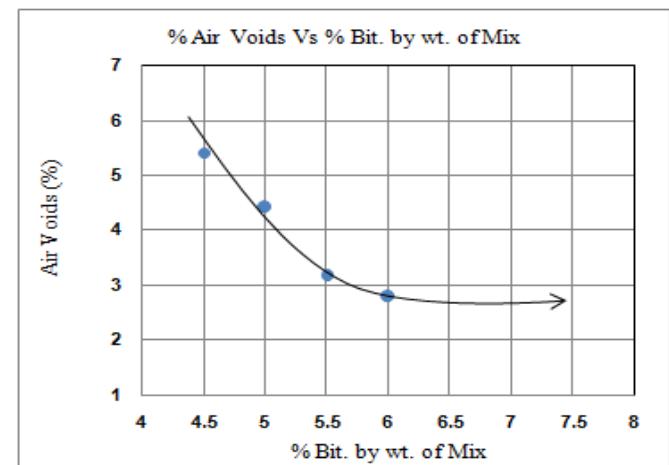


Figure.7- Air Voids v/s Bitumen Content

Marshall mix properties of VG 10 got is at 5.1 % which is chosen further to assess the progressions in properties by expansion of 0.02%, 0.03% and 0.04% dose of Zycosoil substance as an added substance at temperature 175°C by confirmatory test.

Abstract of Marshal Mix Design Test Values (confirmatory test)						
Bitumen content by weight of total mix %	Stability (KN)	Unit Weight in gm/cc	Flow in mm	Air Voids in %	VMA in %	VFB in %
5.1%	16.29	2.511	3.98	4.04	14.36	71.87
0.02% Zycosoil	16.48	2.511	4.00	3.84	14.18	72.97
0.03% Zycosoil	16.66	2.511	4.08	3.73	14.08	73.56
0.04% Zycosoil	16.73	2.511	4.12	3.66	14.02	73.97

Table-4

VII. ASTM 3625 BOILING TEST

Zycosoil special synthetic structure makes it water dissolvable. When it is connected at first glance and is clung to the substrate, the water repellent normal for the particle commands at first glance and gives water repellency. Zycosoil being a nano size atom alters surface by responding with it and thus gives a subatomic level hydrophobic trademark. The surface layer is around 10 nm (0.01 micron). Zycosoil compound can possibly change the surface science of tying with aggregates. Zycosoil in obliged dosages of 0.02%, 0.03% and 0.04% are included dissolved black-top cover to get a homogeneous blend. Standard system is embraced to get ready and samples tested (regular & with Zycosoil) at 100°C and shifted time according to standard.

Test Sample at 100°C	10 min	30 min	1 hour	6 hour
5.1% asphalt binder by weight of mix (without Zycosoil)	92%	92%	91%	90%
5.1% asphalt binder containing Zycosoil (0.02%) by weight of mix	98%	98%	98%	97%
5.1% asphalt binder containing Zycosoil (0.03%) by weight of mix	100%	100%	99%	99%
5.1% asphalt binder containing Zycosoil (0.04%) by weight of mix	100%	100%	99%	98%

Table-5 (Specification <95% : fails)

CONCLUSIONS

The opinion arrived at through a methodology of thinking by experiencing lab examinations experimentally completed on BC Grade-II blends are summarised as follows:

Legitimate degree of aggregates for durable flexible pavement coupled with great compaction are of most extreme significance to decrease the air void substance of bituminous solid blend asphalts inside admissible range according to codal procurement to create the best compromise of pavement strength, durability, raveling, rutting and dampness.

Zycosoil is a water dissolvable responsive organo-silicon section (estimate 50 to 100 nm) that is especially proposed to update the bond in the midst of bitumen of VG 10. It has been noted there is a decline in penetration value with the expansion of Zycosoil as compound with VG 10 blend as the science has changed the property, as solidness has expanded, upgraded state of temperature helpless is noted subsequently expanding the

workability of bituminous blend. As the bitumen is ductile and satisfies the standard criteria, the coating of aggregates is better. In Marshall Mix design marginal difference is seen in the roll of volumetric properties with and without Zycosoil in suitable dosages.

Dampness of the Asphalt solid gets diminished and this is apparent in boiling point test when VG 10 adjustment is seen with 0.03% measurement of Zycosoil synthetic. As Zycosoil is silane based added substance it minimizes the dampness harm as a covering of bitumen is shaped around the aggregate.. In vicinity of water too it goes about as dynamic glue averting stripping. This will expand the life of asphalt.

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